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THE

DRY EARTH SYSTEM.

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LONDON :

E. & F. N. SPON, 48, CHARING CROSS.

1869.

Our attention was first directed to the Dry Earth System at an early stage of its progress. By degrees we became fully persuaded of its soundness and efficiency. We have since that time carefully watched and assisted in its further development. And we now issue the following pages in the belief that they contain a fair and moderate statement of its claims and professions.

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THE DRY EARTH SYSTEM.

THE following pages are intended to supply a distinct and trustworthy statement in explanation of the Dry Earth System. Introductory. It is projected to furnish a brief account of the claims and professions of that system, of the principles on which it is based, and the limits and conditions that affect its operations. And, by way of necessary illustration, some information will also be supplied on what has already been achieved by the system. One thing, and one only, need be asked as a preliminary, and that is, that the question be not prejudged. The most sanguine investigators, whether as theorists or practical men, of the sewerage problems still awaiting solution, will admit that matters are not yet clear and simple enough to justify the exclusion of any new agency, because it is new. The system now about to be described is not put forward as an infallible panacea for the social grievances which it operates upon. It is, however, only fair to ask on its behalf, as on that of any other social claimant, that it shall not be condemned unheard in respect of the claims which it does urge; and this is a demand which we are confident will not be refused by the English public.

The Dry Earth System may be defined to be a method by which surface earth, under certain simple conditions, is applied to the absorption and deodorization of excrementitious matter. By a long series of experiments the following facts Principles of the earth system.

have been tested and re-tested, and at length completely established as principles:—

1. That any surface earth, and almost any clay, will deodorize excrementitious matter, but that sand and chalk will not.

2. That such earth, if dried and sifted, has such power of absorption that it is capable of receiving both liquid and solid excreta, and of rendering their removal practicable without offence, and also without any loss in the value of the manure.

3. That a very small quantity of earth is required, and that the same portion of earth may be repeatedly used with the same effect.

4. That the action of the earth on the excreta is immediate, all fermentation being prevented, the obnoxious agent being dealt with at once and in detail.

5. That, while the earth absorbs the excreta, they in their turn possess a decomposing power such that any extraneous matter deposited with them disappears in a short time.

6. That the absorption and deodorization of the excreta result in preventing infection.

Now, the soundness of these principles rests, as has already been said, on a vast amount of evidence, furnished by repeated experiment. Varieties of climate and soil will clearly introduce slight varieties into the operation of the system; but these are matters of detail, not of principle. Every new application of the system only confirms the belief that it may ere long take its place as the most effective agency that can be brought to bear against the enormous difficulties of sanitary improvement.

The defects of the ordinary domestic accommodation for sanitary purposes, on the systems at present most usual both in towns and country districts; the expensive design, and the frequently inadequate execution outside the house itself, of the

sewer with which it has to be connected; and, more than all, the dangerous, injurious, and (in certain quarters) the increasing pollution of rivers—these are commonplaces with everyone who has reflected even on the surface of the questions involved. It is now contended that the Dry Earth System will effectually help to grapple with and remove the formidable difficulties which at present so often bar the way to permanent conditions of health. Its operation is final and complete. There is no expensive machinery requisite for removal or transit to a distant spot, at which spot fresh problems of difficulty spring up again; for, in working the Dry Earth System, the whole of the transaction subsequent to the operation of the earth may be converted into a matter of profit. It is in any case a matter of ease and simplicity, unattended by anything noisome or offensive; and it may be converted, we repeat, into a matter of highly developed profit.

The system obviously has, and will have, to encounter a double difficulty arising from the very simple character of its basis and principles. There is, first, the prejudice to be encountered which naturally attaches to any very simple remedy for any very complex grievance, until the remedy proposed has won its way to general acceptance, and has grown customary and familiar. On reflection, it will be felt and acknowledged that nearly every valuable discovery in modern social economy has had to encounter the same prejudice and for similar reasons. The application of steam to locomotive uses, and of the electric fluid to the transmission of news, depended on natural laws which were simple and obvious; and in either case a long and vigorous course of opposition had to be met and overcome. But in the case of the Dry Earth method of Sewage, there is a danger of another kind, arising also directly from the simplicity of its groundwork. The conditions of application of the earth being obvious, they are liable on a first experience to be carried out with carelessness or inefficiency.

Difficulties
arising
from its
simplicity.

Either the earth is not dry, or it is irregularly applied, or it is allowed to be acted upon by other substances than the human excreta with which it has to deal. All cases, without exception, that have been submitted to examination, in which some imperfection of the earth agency has been reported, have been distinctly and directly traced to faulty application in one or more of these respects.

Various
fields of
operation.

It will be clear to any practical investigator of sanitary subjects that the fields of possible operation open to the Dry Earth System are very various. There is, for instance, the important sphere created by large institutions, such as Asylums, Gaols, Reformatories, and Schools. There is, next, its application in country districts, whether in the large dwelling-houses of the owners of property, or in the cottages of their labouring population. And last, but not least, come the towns. On each and all of these possible areas of application we shall have something to say; for, fortunately, the Dry Earth System is not now claiming public attention as a new and untried *modus operandi*. It cannot be too often repeated that it has at its back a mass of practical evidence, sound in nature and constantly increasing in quantity. It has also undergone the tests, and received the decision, of a large number of practical men, whose partial approval in some cases is no less important than the unqualified approbation given in others. For it is obvious that commercial interests in certain quarters, and elsewhere the opinions to which men of science and ability have become wedded after a great amount of labour and investigation, must necessarily present formidable obstacles in the way of a system the principal features of which are its simplicity and its inexpensive character. These are obstacles, and they will unavoidably be so to a greater or less degree wherever they exist, not only to the reception of the Dry Earth System, but even to a fair and candid consideration of its claims. And hence we repeat that this is a case where even a

Nature of
evidence in
its favour.

partial approval carries more than usual weight, and where an unqualified acceptance is doubly significant.

I.

We will now proceed to enumerate a few of the important cases in which the System has been successfully applied on an extended scale. The largest asylum in which it has been carried out is the Convict Lunatic Asylum at Broadmoor, Berks, where upwards of sixty earth-closets are now in use, and more are about to be fitted. This building was originally supplied throughout with water-closets, and the whole of the drainage was carried out under Mr. Menzies' direction and on his system. It was found, however, that these appliances were a constant source of expense and annoyance; and recourse was had accordingly to the Dry Earth System. The necessary measures were taken under the superintendence of the Clerk of Works, and the Government's own workmen were employed. The sulliage is still passed through the drains laid down by Mr. Menzies, and it irrigates some grass lands in the adjacent valleys. The whole of the ashes in the asylum are used in conjunction with the earth, which is dried on a kiln built for the purpose. The simplicity and completeness of the system are admirably illustrated in this establishment, and are well worthy the attention of those who, while admitting the main principles and beneficial results of Dry Earth conservancy, labour at the same time under an impression that its working is a matter of difficulty and complication. Broadmoor proves the exact opposite of this apprehension, and the experience there obtained is on a scale quite large enough to be conclusive. The ashes mentioned above are sifted, and the cinders thereby obtained are the only fuel required for drying the earth in the most efficient manner. No difficulty whatever is experienced in carrying out these details, and the valuable manure thus

The system as applied to institutions, in camp, and in India.

Broadmoor.

obtained is employed on the farm attached to the asylum. It may be mentioned that the pluvial waters are not allowed to enter the drains, but are carried off by separate pipes into a large pond.

Reading.

The Reading Union Workhouse is another establishment where the system has been put into operation by the advice of Mr. Baldwin Latham, and in which it works with complete success.

Dorset
County
School.

In the Dorset County School, an institution at present situated within the town of Dorchester, the Dry Earth System has been in operation for more than three years. The ordinary system previously employed had resulted in trouble and annoyance perpetually recurring. In this school the everyday working of the Earth System has been found equally commodious and economical, and particular testimony has been furnished by the head master in regard to the complete success attending the removal of the earth from the premises. It is worthy of attention that the *locale* of this large establishment is about to be removed from the county town itself to a site about a mile and a half distant; and that ample provision for the working of the earth system has been made an integral portion of the design for the new buildings.

Oscott and
Isle of
Man.

At St. Mary's College, Oscott, near Birmingham, an important and carefully worked institution of long standing, the system has also been for a considerable time in operation, and extremely satisfactory accounts of its working are received from thence. Similar reports have been sent from the Manx Lunatic Asylum, Isle of Man, and from many union workhouses and factories, both in England and Ireland, besides the important one of Reading, mentioned above.

Wimble-
don.

It was at the Volunteer Camp during the Wimbledon Meeting of 1868 that the earth system underwent what has, perhaps, been hitherto its severest ordeal, and achieved its greatest success. An unqualified testimonial was given by the

Surgeon-Major in his Medical Report on the Meeting. The whole of the leading daily papers corroborated his testimony, and from a large collection of such documents as they have supplied, the accounts to be found in the *Times* and the *Lancet* are too important to be omitted. They are accordingly here subjoined:—

FROM THE "TIMES," JULY 24, 1868.

"It would be doing an injustice to one of the greatest improvements introduced by the Association at the present meeting, if mention were not made of the excellent working of the Moule, or dry-earth system, as the basis of the sanitary arrangements of the camp. Hitherto, chloride of lime, flushing, and various other expedients have been resorted to, and have worked more or less successfully, but always with drawbacks of a too obvious character. This year the increased numbers in camp, and the fearfully trying heat, would have found out the weak places of a water system, and possibly have proved a source of danger as well. The Moule system, on the contrary, after the severe ordeal to which it has been exposed, has come out triumphant. The building where it is at work has been frequently visited by members of the Council and by officers of the Staff, and at no time could anything disagreeable be discovered. That more than 2000 men—Regulars, Volunteers, &c.—should live in camp, and that there should be absolutely no annoyance of any kind, after a fortnight of such weather as there has recently been, is a fact of which it is impossible to exaggerate the importance."

FROM THE "LANCET," AUGUST 1, 1868.

"The strongest possible testimony has been borne to the efficacy of the "dry-earth system," which was in use throughout the Volunteer encampment at Wimbledon. Last year the system was experimentally tried, and resulted so satisfactorily, that it was determined to adopt it this year

exclusively. There can be no question that the test to which the system has thus been subjected was a crucial one, considering especially the excessive heat, which, although favourable to the rapid drying of the soil, was yet creative of other conditions increasing the difficulties attendant on faecal deodorization. Altogether, some 148 dry-earth closets and urinals were in operation at Wimbledon, and when it is remembered that about forty or fifty of these closets were used daily by not less than 2000 men without the slightest annoyance to sight or smell, the measure of success is complete. It is not too much to say that no other system is possible at Wimbledon, where circumstances have all to be made to square with a temporary requirement. But if the dry-earth closets can stand the test of such repeated use as they have lately had, it seems to us to follow as a matter of course, that they must be in every way suitable for the exigencies of rural districts.

“That the system is destined to make great and rapid progress we cannot doubt, especially as by the Sanitary Act (1868) Amendment Act, which has passed through both Houses, it is provided that ‘any enactment of any Act of Parliament in force in any place requiring the construction of a water-closet shall, with the approval of the local authority, be satisfied by the construction of an earth-closet, or other place for the reception and deodorization of faecal matter, made and used in accordance with any regulation from time to time issued by the local authority.’ The earth-closet, in fact, is to become a legalised ‘institution,’ on a par with the water-closet, and local authorities will have now the power of adopting which of the two systems they please.”*

The actual number of closets in the Camp was 108, and of

* With these selected opinions from the press should be read the letters (quoted page 14) of Colonel Colville and Captain Drake, R.E., the Camp Commandant and the Engineer Officer at Wimbledon.

urinals 46; the aggregate number of volunteers was 2300, and the number of visitors admitted to the grounds, according to the published returns, reached 34,792. Yet, although this was the first occasion of an application of the system on so large a scale, and notwithstanding the unusual heat of the weather, the experiment was pronounced on all hands to be a decided and complete success. When we have added that no difficulty whatever was met with in procuring a supply of earth, nor in conducting certain cases of necessary removal, we think that sufficient ground has been given for asserting that the applicability of the earth system to camps has been substantiated beyond doubt.

This will be the proper place to mention, and, as we hope, to dispel, an apprehension which has lately been expressed respecting the Earth System, and which, if it could be shown to rest on valid grounds, would bar the way *in limine* to its adoption. It so happened that the Camp at Wimbledon during the meeting of 1868 was not free from attacks of diarrhœa. Certainly no advocate of the Earth System was ever sanguine enough to entertain the belief that the Volunteers would gain, by its adoption, a complete immunity from such forms of disease; and the extraordinary and long-continued heat rendered it more than probable that attacks of the kind would prevail pretty widely.* There was scarcely a district in England at the time where similar symptoms were not in some degree becoming apparent, and there was no conceivable reason why the Camp itself should remain exempt. Accordingly, on the appearance of diarrhœa, it was the most natural thing possible that persons who were not convinced of the soundness of the Earth System, and who entertained opinions or prejudices against its adoption, should connect this particular form of disease, not with the hot weather and the various unhealthy circumstances arising from that source, but

Contro-
versy arising out of
the Wimbledon
meeting.

* See Captain Drake's letter, p. 15.

with the application of the new method. Nothing of this kind appeared at the time, so as to qualify, as it would have been natural to expect that it would do, the universal verdict of approval. Since the meeting, however, the suggestion has been made, that while the Earth System deodorizes it does not at the same time ensure disinfection. And the specious, but (we venture to submit) the entirely delusive analogy of the rattlesnake has been brought into play. This analogy is so specious, and so neat, that it is almost a matter of regret to expose it; but it is so singularly delusive, that no one will hear without surprise of its having originated with a man of scientific knowledge and experience. What is alleged is this: that "a rattlesnake is none the less dangerous because its rattle is removed; and that, for anything shown or known to the contrary, odour is to infection, deodorization is to disinfection, what the noise of the serpent is to its bite."

Earth prevents infection,

Now, it cannot be too often, or too emphatically and distinctly stated, that, although deodorization is secured by the Dry Earth System, deodorization is not its main object, nor its prime achievement. The Earth System absorbs and completely disintegrates, and practically annihilates, the substances with which it deals; and deodorization, though a necessary and a very valuable concomitant, is no more than a concomitant of these processes. Hence, as it has been ably observed, the Earth System does not content itself with destroying the "rattle" of the snake, but it lays hold of the snake itself, and either strangles him in his birth, or tears him into a thousand atoms. It achieves this result by absorption, by causing the entire absence of fermentation, and by the most minute disintegration. All vapour or gases exhaled by the obnoxious substances are completely taken into the earth covering it; and the finer the earth, the more entire is the interpenetration. So complete is the result, that the interpenetrated substance may remain where it is deposited, in the same in-

nocuous state, for several weeks or months. Or if it is immediately removed and suffered to lie together, under cover, for four or five weeks, it may be dried without any sort of injury or offensiveness. And when the drying process is finished, the same substance may be safely transported to any distance, and handed over to the gardener or farmer, on whatever soil he may be engaged, as a valuable manure. Nor is it of possibilities only that we are speaking, but of actual facts, repeatedly performed and minutely tested.

In order to be captivated by the fallacious analogy of the snake, an investigator must still be labouring under a false impression with regard to the Dry Earth System. The mistake of which we speak is found to be a constantly recurring one, and is so difficult to eradicate, not only from the conception of ordinary persons, but of scientific investigators also, that we must not pass it over in silence. It has been from the first, and it still is, erroneously supposed that the Earth System claims to deal with obnoxious matter *in the mass*. So far from this being the true state of the case, it should be distinctly grasped that any such claim would strike at the very basis of the system. Universal experience has shown that to deal effectually with the mischief in question by means of earth, *in the mass*, is a matter of almost entire impossibility. Such an attempt would at any rate be attended by risks not less than those which are being daily proved to beset the older methods. But the very first law and fundamental condition of the dry system is, that the substances shall be dealt with *at once* and *in detail*. It is this condition, and this alone, which renders certain the valuable results which have in so many cases been achieved; on this depend deodorization, absorption, and innocuous removal, the detailed application being in all cases presupposed to be of earth fairly and thoroughly *dried*. And it is this essential condition which is left out of sight, when fears are expressed about the injurious results to health that may be apprehended

when it is
applied,
not in the
mass, but
in detail.

from the faecal impregnation of soils. The very basis of the Earth System renders any such fear not only improbable, but impossible. And the question between earth and water has, therefore, been truly and ably stated to lie between "a system which, if rightly worked, does deodorize and prevent infection, and a system which cannot deodorize and does not pretend to prevent infection."

Evidence of
Colonel
Colville and
Captain
Drake,
R. E.

This controversy has called forth an expression of opinion from several of the officers who had charge of the Wimbledon camp, including its sanitary arrangements. Lieutenant-Colonel W. G. Colville, Camp Commandant, writes thus:—

Colonel
Colville.

"There can have been no doubt of the success of the Earth Closets at Wimbledon in 1867.

"In 1868 the trial they underwent was a far more severe one, and on the whole, I consider they stood it extremely well.

"Certainly, under no other system could latrines have been suffered at all in the midst of closely pitched tents."

The operation of emptying some of the latrines "was performed in the middle of the night, without (as far as I could ascertain) the knowledge of the occupants of the surrounding tents—a rather remarkable fact. . . .

"I am strongly of opinion that bearing in mind the necessity at Wimbledon of having the latrines so near the tents, under no other system would the camp have been so healthy.

"I have a vivid remembrance of the offensiveness of the latrines in 1865, 1866, and should be sorry that such a state of things should recur."

Captain Drake, in a letter addressed to the *Lancet*, and dated April 22, 1869, gives the following remarkable evidence:—

Captain
Drake,
R. E.

"I have been engineer officer in charge of the works at Wimbledon for the last seven years, and the sanitary arrangements have always been my principal source of anxiety. The

difficulties are—an increasing number of men, very limited space, no drainage, no money to lay drainage or place to drain into, no out of the way place which is not open to view of sight-seers, water at four feet from the surface, the necessity for appearance, &c. . . . Open latrines and water-closets then would not—in fact did not—succeed. As far as I know, there remains but the earth system, and that did succeed. . . . We tried one latrine in 1867. This was built in an out of the way place, and it was very much used, volunteers going to it from all parts of the camp, and telling me that they did so because it was superior to the water closets nearer to them.

“In 1868, then, Moule and Co. erected all the latrines. These latrines were constantly inspected by the medical officers, by the camp commandant, by persons sent by me, and by myself. They worked well, were well tended by the servants of the Company, had very little smell, and that little was cured by the use of carbolic acid in the passages. . . .

“Some of the latrines were emptied during the meeting, without any inconvenience being felt. Could this have been done had any other system been used? . . .

“As to diarrhœa, I suspect the amount of trash consumed under the name of ‘coolers,’ the fruit, the beer, and the great heat had more to do with causing it than the dry-earth system of sewage. I have been a good deal under canvas, and I never knew a camp in hot weather without diarrhœa; and it is my firm belief that had the dry-earth system not been used last year, we should have had fever, if not cholera, in the camp. . . .

“Certainly it would be impossible to give the system a severer trial than at Wimbledon.”

These two letters speak for themselves; and, when taken in conjunction with the unofficial, but decided and unanimous, reports of the press, they form a concurrence of varied testi-

mony which is not often met with in support of a comparatively new agency.

Application
in India.

It was in the year 1863 that Dr. Mouat, Inspector-General of Gaols in India, first resolved on calling in the aid of the Dry Earth System towards the reform of some of the abuses and inconveniences to which the Indian gaols had long been subject. His attention had been arrested by a paper read before the Society of Arts by the inventor of the dry conservancy system, Rev. Henry Moule, whose name has now become associated permanently with it. That paper was soon afterwards published and circulated throughout the whole of the three Presidencies by order of the Indian Government, and during the year 1864 the system had already been put into operation in a hundred public buildings, sixty of these being gaols. At Alleypore it has been applied to a gaol containing 1500 inmates, and at Mooltan to a gaol of 700, with very great success. And these are only isolated specimens of a movement which in an almost unprecedentedly short space of time became general. It will readily be conceded that a very manifest act of injustice would be done to the dry conservancy system if its merits were made to stand or fall by the success or failure reported from any one specimen of these Indian gaols; for it is to be recollected that the application of the system was made principally under the guidance of the paper read before the Society of Arts, to which reference has been made above; next, that the necessary measures were adopted on the spot, without any superintendence from those who were responsible for the system in England; and also, that in the case of so enormously extensive an adoption, a very considerable number of instances of faulty, or careless, or ignorant administration would necessarily occur. An experiment so general, and covering so vast an area, is, in common justice, to be tested, not by single cases, but by the aggregate result.

And the aggregate result was this: the Inspector-General reported on the system that it was, in his judgment, "the "greatest public benefit, without exception, ever conferred by a private individual in a matter so essential to public health." From military officers and civilians alike a cordial attestation was received in evidence of the great and general relief afforded. The Indian Government issued a Commission of Inquiry; and, on the reception of a report from that commission, the inventor of the system received from the Indian Secretary in Council a mark of official satisfaction and approval; and the Secretary of State for the Colonies directed a copy of the same report, together with copies of reports received from the Inspector-General, to be sent to the Governors of all colonial dependencies.*

In all cases, without exception, where a failure has occurred, it is submitted that such failure is distinctly traceable to hasty or erroneous application, contravening in some one or more important points the fundamental principles of the Dry Earth System.

II.

In now advancing to the application of the Dry Earth System in villages, and in the farm houses and labourers' dwellings on estates, we approach a question of much more serious interest and magnitude than would appear on a first glance.

Application
to villages,
and in
country
districts
generally.

There is more than one point of view from which to examine this important subject; and it will be convenient here to regard it, first, in reference to health, and, next, in reference to economy, including under economical considerations the details of management and administration.

* In Nos. XIII. XIV. of "Selections from the Records of the Madras Government," issued during this year (1869), a considerable number of official and medical reports have been republished, all more or less confirmatory of the system.

The sentiment of the picturesque has unquestionably given much support to the natural tendency to let things alone which prevails in every rural district, and which forms so grave an impediment, not only to the formation of clean and provident habits, but to the establishment of the simplest conditions of health. A deservedly high authority in agricultural science* has recently given a re-statement of this grievance, which will never be removed until daylight has been repeatedly and unsparingly brought to bear upon it. It has been, as he observes, so much the *custom* to regard the pretty thatched cottage of the village as the home of comfort and cleanliness, that the uninitiated are surprised to learn that fever and other contagious maladies are more readily associated with the picturesque thatch of the hamlet than with the unsightly slate and tile of the crowded town. In the meanwhile, more practical observers are well aware that behind many of the prettiest cottages there lurks a sickening malaria which, if detected in a town, would at once be dealt with as a nuisance. The ready seeds of disease are festering from one year's end to another in the outbuildings adjacent to the back door and windows. This state of things has, from long usage, become a matter of indifference to the owners of cottages, and a matter at any rate of habit to the labourer and his family. Trusting to the fresh air around them, they are contented to exist with confined and foul air within the cottage, and with a varied description of noxious matter at the threshold.

Death rate
of villages.

The first and obvious consequence of this condition of things is, that the death rate of villages often runs alarmingly high. The Registrar-General's returns repeatedly show a much higher proportional rate in small villages than in large towns. For it must be recollected that malaria represents only one portion of the danger which besets village dwellings. The shallow wells, which are so generally the sources of water

* Mr. Bailey Denton in "The Agricultural Labourer" (No. 2), 1869.

supply in a village, stand frequently in close proximity to cess-pits; and when once the soakage from these has touched a well, an evil of the most serious character is called into operation. Occasionally the evil culminates. It was early in 1868 that public attention was called, forcibly and repeatedly, to the condition of the village of Terling, near Witham. In February of that year, typhoid fever had made such rapid progress there, that out of 900 inhabitants, 300 had been attacked, and 34 deaths had occurred. Precisely at the same time, the towns of Worcester and Tamworth were suffering widely under different forms of typhoid. A specimen of Tamworth drinking-water was submitted to Mr. Way, and was found by him to be "of a very dangerous character, the lowest proportion of solid residue being about five times as much as in the average of London waters." The fever at Terling was proved to depend upon exactly similar causes. The village was honeycombed with cesspools; and, though these might be repaired, it was unavoidable that the cement would be perpetually giving way, and that the surrounding soil and adjacent waters would be dangerously vitiated.

The calamity which culminated at Terling is now impending, or is already in a lower degree felt, in an indefinite number of English villages and rural districts. And it is very essential to recollect that even the death-rate of such districts, ominous as it is, will be found to be no complete measure of the sanitary evils existing there. It is not only an excessive number of deaths, but a low standard of vitality, that mars the ideal perfection of picturesque villages. A low standard of vitality is traceable in the lassitude, physical and mental, often exhibited by the rural labourer; in an apathetic indifference to his own interests; and in the feeble resistance which is all that, in a large number of cases, his class are able to make against attacks of disease. Vitiating air, soil, and water are not the only agents that produce this low condition;

Low standard of vitality.

but it is inevitable that they should operate as very powerful agents indeed.

Few villages where a supply of water could be easily turned to sewage purposes.

Now, it is clear that, if cesspits are to be discontinued,* one of two courses must be selected. Either the sewage must be immediately and completely removed from the village, or a course of treatment must be adopted which will render it perfectly innocuous. There are not many villages in England that possess such a supply of water, capable of being so served, that the first of these processes could be worked successfully. Even were this condition reversed, reasons could be adduced, and certain economical reasons will presently appear, showing why this method of water removal would be an unfortunate one to adopt. But we prefer resting the argument on the simple matter of fact stated before, that very few villages in England possess a water supply which could be made available for sewage purposes. We are thus reduced to a method of treatment which no existing method provides so completely and efficiently as the dry earth closet. This system has been well described as the attainment, after years of spasmodic inquiry and experiment, of a safe means of dealing with village sanitary questions.

Earth system recognised by Sanitary Act of 1868.

The Sanitary Act of 1868 has now furnished a sound basis of operation, on which to proceed to the application of the Earth System. It not only recognises the earth-closet as an established agent, and empowers local authorities to supply earth when that may be required, but it contains provisions in virtue of which the benefits of scavenging may be secured to the smallest community.

Duties of a public scavenger under the system.

In regard to the Earth System itself, the duties of a public scavenger would be simple and completely unobjectionable. He would make periodical visits to the cottagers' dry closets, and see that earth is applied in proper quantities, and in a

* Mr. Bailey Denton, *ibid*.

properly dried condition. He would further see that the soil, when mixed with the excreta, is removed to the cottagers' garden, or, where no garden exists, that it is taken away for use by others.*

With these duties, it is obvious that he could unite an analogous supervision over water drainage, where that method might be still retained ; so that the dry earth system and the water system could be made to work together in a village where a general adoption of the former could not be carried out.

But the work of the public scavenger would not terminate here. In addition to the obnoxious refuse which the Earth System treats, there are in all habitations the liquid refuse substances of the kitchen, the washhouse, and the chamber, to be provided for. Such provision may be made in two ways. The liquids may be either earried off by a system of sewers, the construction of which would be a light and inexpensive task as compared with the ordinary sewer which is made to convey solid and liquid refuse alike. Or, otherwise, they may be conveyed, by sub-irrigating drains, into the soil of the adjacent gardens, and there used as a valuable supplementary manure.

In the first of these cases, the public scavenger would superintend the measures necessary for the filtration, deodorization, and partial purification of the liquid substances, before they reach the street sewer. These objects would be aimed at by draining the liquids through some available medium, such as a compost heap, in which ashes would be a principal ingredient, and by the use of disinfectants where these might appear to be necessary. And, in the case of sub-irrigation, the scavenger would see that the necessary drains were in good repair, and that the sewage liquid was

* Mr. Bailey Denton, *ibid.*

actually and effectively utilized in the gardens. This method has for many years been adopted with great success by the inventor of the Dry Earth System.

Value of
manure
under the
system.

With respect to the economical side of the questions affecting the Earth System, as applied in country districts, we cannot do better than quote, almost *verbatim*, an estimate from the authority to whom frequent reference has been already made, and whose calculations will be accepted as entirely free from tendency to over-statement. The money value of human excreta, when chemically tested and compared with the selling price of guano, is from 6s. to 8s. per annum for each individual. If the usual estimate of five persons to the family is taken, and if the whole refuse of a labourer's household is preserved for use by mixture with dry earth, the value may safely be put at the *minimum* of 30s. a year. The value of a good load of farm yard manure is 6s. ; and it therefore follows that, in the sewage of his household, the labourer has the equivalent of five loads of farm manure, which is quite enough to maintain a rood of ground in the highest gardening condition, if, with reference to the cropping, it be applied to half the land each year.

This estimate has been given as being at once a valid argument in favour of the use of the Dry Earth System in rural districts, and a *minimum* calculation which no one will dispute. But it is only fair to add that a much higher estimate has been deduced from facts entitled to attentive consideration. We will confine ourselves here to the evidence furnished by the contractor for the supply of earth used in the Dorset County School. The operation of removal is conducted by him once in three months. He has tried the manure so manufactured on various crops, and considers its value to be, when dry, between 2*l.* and 3*l.* per ton. In the course of a year 42 tons are obtained, and, if the lower figure of 2*l.* be taken, the total value for the year will stand at 84*l.* The school contains

about 80 boys, so that by this calculation the annual value of refuse for each individual would reach 20s. instead of 6s. or 8s.

III.

We now have presented a condensed account of what the Dry Earth System has achieved, and of what in our opinion it is capable of doing, when applied to large institutions and to rural districts. The great question of town sewage remains. And, in discussing the applicability of the Earth System to towns, we must guard against a misapprehension that is not unfrequently entertained. It is often supposed that the advocates of dry earth are willing to represent themselves as prepared to deal at the present time with the sewage of all towns whatsoever, no matter of what magnitude or under what conditions they may be. Now, the engineers concerned in the promotion of this system are not so new to the difficulties and complications of the problems involved as to claim on behalf of any single method that it shall at once establish itself as an infallible solution. On the contrary, at a time when the treatment of sewage in towns of the first magnitude is in a completely empirical state, and when vast sums have been, and still are, expended on experiments of great extent, they would be satisfied to see dry earth fairly adopted and proved in towns of a small or moderate size. In the meanwhile, they would not resign or negative wider claims in regard to earth conservancy, but they would be content to hold these in abeyance, and to abide by the results of the development of the system within the more moderate limits just specified.

It has been before urged that, in the case of a method which runs counter to a large number of interests and usages, and which is remarkable chiefly for its simplicity and inexpensiveness, even a partial approval, from an official source, or from any independent quarter, is to be regarded as possessed of

Applica-
bility in
towns.

Colonel
Ewart's
report on
towns in
the Thames
valley.

more than ordinary value. And we shall therefore offer no apology for introducing in this place certain extracts from Lieut.-Col. Ewart's "Report on the proper Principle of Drainage to be adopted in the towns of Oxford, Eton, Windsor, and Abingdon (1868)." The favourable verdict will speak for itself, and on those passages which take exception to the Earth System we will offer a few remarks. In Clause 33, Col. Ewart observes that—

His
approval of
the system.

"Earth-closets undoubtedly neutralise, most efficiently, the nuisance arising from human excreta, and make their removal a question of ordinary mechanical transport; and it is impossible to rate too highly the beneficial effect of their adoption in cottages, detached buildings, hot climates, and, in short, any place where a supply of water is deficient or difficult of attainment."

Col. Ewart then proceeds to state that, in his opinion, the suitability of earth-closets to towns is a question of a different character. And, in Clauses 35—40, he lays down the following propositions:—

His
objections.

That it would be difficult, if not impracticable, to combine water and earth as systems of operation in "the same part of a town."

That water drainage must be provided for the exigencies of an existing water system; that, this being the case, little would be gained by excluding from the drains the obnoxious refuse of a small portion of houses; and that a separate system of scavenging for these houses alone would be an expensive concern.

That doubts may arise about the certainty of an earth supply for a large population, and about the feasibility of removal.

That doubts may also arise about "the relative expense of carrying earth to the excreta instead of carrying the excreta to the earth by water-carriage," regard being had to the removal

of the refuse liquids, which cannot practically be done on a large scale, except by foul drains.

And that, therefore, earth-closets cannot be advantageously used, except in certain detached parts of towns, and in certain other places where water supply may be difficult, or water drainage obstructed; but that, in such quarters, the dry system "may be employed, at least temporarily, with advantage."

With reference to these propositions we proceed to subjoin a few observations.

It is perfectly true that, if the water system be adopted, water drainage must be provided, and that not much would be gained by excluding from the drains the obnoxious refuse of a small portion of houses. But, on the side of the Earth System, it is contended that no cause, sanitary or economical, can be shown for the requirement of water at all for the main system of drainage in ordinary sized towns and large villages. It is notorious that in a great number of such places there exists an ample water supply from the wells attached to each house, or from public wells or springs, and it is clear that in such places water works are not wanted for the sake of the water, but the large expense incurred on their account is, so far as water alone is concerned, unnecessary. It is nothing to the purpose to suggest that these wells may be contaminated, since the adoption of the Earth System would effectually prevent existing contamination, and make its future recurrence impossible. In such towns, therefore, water works would be devoted to no other purpose but one which is here maintained to be as unwholesome and uneconomical in its operation as it is costly in organisation and adjustment. We mean the forcing through drains, by means of water, of the whole sewage, liquid and solid, of a town. And while it is undoubtedly true that small gains would follow on excluding from a system of water drainage the solid refuse of only a small number of houses, we respond that everything would be gained by excluding from

Discussion
of his
objections.

these drains the whole solid refuse of the town. It should be added that the small system of drains required for the liquid refuse, if earth were applied to the extermination of the solids, would not require more than one-third of the cost bestowed on drains under the water system.

When Colonel Ewart speaks of the expense of scavenging, he is obviously contemplating a scavenging apparatus over and above an existing water drainage. But we may avail ourselves of this opportunity to remark that the expenses of scavenging under the Earth System must always be discounted by credit given for the profit arising from the manure.

Regarding the certainty of an earth supply, that is a question of local consideration. No engineer would undertake to pronounce a constant supply of earth to be certain in the case of a town which he had not inspected, any more than he would guarantee a constant supply of water. But one point may be regarded as positive and certain, namely, that from the day when the neighbouring farmers began to appreciate the value of the manure—and that is a value which they are not slow in estimating rightly—the local board in any town whatever would experience no difficulty in obtaining an ample earth supply. Convincing evidence in proof of the feasibility of removal in towns has been furnished by the case of the Dorset County School, an institution to which reference has already been made, and which is at present situated in the High Street of the county town.

When Colonel Ewart speaks of the relative expense of carrying earth to excreta and the excreta to the earth, he is apparently speaking of two cognate processes, opposed to each other only in point of sequence. But this is far from being the real state of the case. So far from the processes being kindred ones, they are essentially and fundamentally different. By the application of earth to the refuse substances, on the principles involved in the conservancy system, those substances are rendered

innocuous, and, on being absorbed into and amalgamated with the earth, they are capable of innocuous removal and economical use. On the transportation of the same substances to the earth by means of water carriage, their deleterious nature is in many cases not perceptibly diminished. In no case is it, or can it be, destroyed or removed. And, by this system, instead of wholesome conveyance and economical use, we have considerable risk and danger in the conveyance and an unremunerative application. The earth is denied the exercise of her own sanitary properties, and she is refused the benefit of those substances which, when properly acted upon, are remarkably stimulative to production, but which when drenched and imported *en masse* are useless, if not dangerous.

Colonel Ewart has admitted that the earth system may be advantageously employed where water is at a *minimum*. And therefore, having regard simply to the merits of that system itself, we venture to assert that he has made no valid allegation against its use where water is at a *maximum*. We have only further to observe, in reference to his Report, that, whereas he has expressed a doubt about the drainage of stables and similar buildings, where the Earth System is adopted, he is here speaking without an acquaintance with the facts. Remarkable success has attended the application of earth in the case of stables, cowsheds, piggeries, and farm buildings of that description, and the most wholesome effects have followed.

The supply of earth, in any town which might adopt the system, should be undertaken by the Local Board of Health, and all necessary measures should be superintended by their officer. As a water system could not exist generally throughout a place of any considerable size without a supply of water regularly furnished, no more can the Earth System without a supply of earth. And in effecting this object, no difficulty, trouble, or cost will be experienced, bearing any comparison with what is now encountered by the adoption of the water

Supply of
earth
should be
undertaken
by Local
Boards.

system. The economical uses which have been shown to be possible under the Earth System, and the many expenses entailed under the other system by the frequent bursting or stoppage of pipes in winter, and the many necessary repairs, are considerations sufficient of themselves to establish this point.

Comparative cost of earth and water.

The comparative cost of the two systems, when applied in towns of moderate size, has been ably and forcibly illustrated as follows.

To carry out the water system in a town of moderate size, the public works alone would require an outlay of between 12,000*l.* and 15,000*l.* The water supply, of which the greater portion goes to the domestic sewage and the flushing of the sewers, will be daily not less than 300,000 gallons, or about 1370 tons, for a population of 7000.

On the Dry Earth System, the public works would consist, not of deep, large, and costly drains and sewers, with costly pumping apparatus for flushing, but of surface drains, which will often be found already existing for the rainfall; and perhaps of very small drains just below the surface for the sink water. Instead of 1370 tons of water raised and distributed daily at a considerable cost, 10 tons of earth would be found amply sufficient. And, as the same quantity of earth would admit of at least three uses within the year, the whole annual requirement would not go beyond 1000 tons. It is worth while, as we need scarcely observe, seriously to contrast the daily consumption of 1370 tons of water with the annual consumption of 1000 tons of earth. Nor must it be forgotten that, while the water effects a waste even if it does not do worse, the earth promotes health and produces a profitable return.

Milanese system costly and complex.

The comparative details just mentioned bring out into strong relief the simple and inexpensive character of the Dry Earth System as contrasted with every other scheme that has been suggested for the sewage of towns. A good deal of

attention has recently been bestowed upon the method adopted in the city of Milan, which, as it is an attempt to work back on the old tracks, and to conduct the abandoned system of cesspits on sound principles, may be allowed the merits of boldness and ingenuity. By the Milanese method, which has also been partially introduced in Paris, the sewage matter is conducted into receptacles, air-tight and water-tight, and is removed thence by special carts provided with vacuum reservoirs into which the sewage is drawn up through pipes for conveyance to the neighbouring country. This agency, as we have already said, is bold and ingenious; but costliness is not the only consideration in regard to which it stands on a footing far inferior to the Earth System. It is not our opinion, but that of Colonel Ewart, that no scheme of town drainage can be recommended which is dependent on mechanical arrangements of great complexity, and in which serious risks to health would be incurred if any fracture or defect were to arise in the machinery used, or any of those failures were to happen which are necessarily incidental in practice to such a scheme.

The questions of expense and of the pollution of river-waters are closely connected together. For it can be shown, as all ratepayers who have considered the subject are well aware, either that the adjacent waters to a town, and very probably also waters at a distance, seldom taken into the account, must be vitiated and polluted by its sewage, or that an expense must be incurred which is out of all proportion to what a civilised community ought to be paying for the attainment of the object in view.

The subject of tainted river-waters has now for some time been regarded as a question of national magnitude. The condition of the Thames produced the Thames Navigation Act, which interposed to necessitate the distribution of sewage over land in such a way as to attempt the purification of the liquid before allowing it to enter the stream. Until that Act was

The pollution of river waters.

passed, the Thames, before reaching the point at which its supply of water for London was obtained, received the sewage and drainage of towns and villages containing more than seven hundred thousand inhabitants. The Medlock and Irwell at Manchester, the Mersey at Stockport, the Tame at Birmingham, with a large number of waters similarly connected with towns of great size, were recently, and probably still are, in a condition considerably worse than that of the Thames. And there is a special case in the North of England, which can hardly be passed over without particular mention. The river Calder receives through the Hebble a large quantity of the sewage matter of Halifax, a borough containing a population of 30,000. As the Calder flows on to Wakefield several other places discharge sewage matter into its waters, until at Wakefield it receives the refuse of a population of 26,000. Four miles only below this town, a water company pumps the water to be sent back into Wakefield, filtered, for ordinary consumption !

Systems of
irrigation.

Now, while we are perfectly free from intending any systematic attack upon the various systems of irrigation which are at present on their trial, we call attention to the fact that these systems of protection for rivers are eminently and disastrously expensive. It is quite open to urge the reply that no expense can be too great when the object is to ensure human life and health. But this plea carries little weight. The value of life and health is no doubt incalculable, but the cost of preserving life and health on intelligent principles is a matter of calculation and estimate, and this estimate, as we maintain, is habitually exceeded to a very large extent.

Without canvassing either the "joint" or the "separate" systems of drainage in detail, it may at any rate be observed that, beyond the prime outlay, which is itself abnormal in social economics, the first system is weighted with additional current expenses from its liability to deranging accidents, and

the other from its complexity. By the "joint" system all the rainfall which descends on the drainage area is carried into the same sewers as the sewage matter. The surface waters are thus perpetually carrying into the sewer fine sand and other street material, which, combining with the sewage-refuse, often forms a mass that has to be removed with much trouble and expense. The effluvium from this mass often finds its way into the streets through the openings for the passage of rainfall or supply of fresh air; and, where traps are ill-constructed, foul gases force their way into dwellings. Besides which forms of mischief, the mixture of rainfall with sewage matter makes the quantity of liquid issuing from the outfall a matter of complete uncertainty, and hence in low-lying neighbourhoods of grave and repeated annoyance.

Without alluding further to the complexity of the two sets of drain-conduits required under the "separate" system, in which the rainfall is kept distinct from the sewage matter, we may remark on the score of expensiveness that Colonel Ewart advocates the rental by the town authorities of not less than one acre for every 100 of population for the disposal of sewage under this system, which is the method of his choice. A town of 7000 inhabitants would thus require an area of 70 acres to be secured for their use, in addition to the large prime expense of public works, and the long array of incidental cost subsequently incurred.

On behalf of the Dry Earth System we now draw together the claims which have been briefly explained in the foregoing pages. We submit to the consideration of local health authorities, and of the large class of landowners and other practical men who have an immediate interest in the important issues involved:—

That the Earth System is not now before them as an untried agency;

Concluding
summary.

That in a conclusive number of large institutions, and on a scale of conclusive magnitude in the Camp at Wimbledon, its feasibility has been severely tested and fully established ;

That its applicability in rural districts, which is a point most generally conceded in its favour, is strengthened by the circumstance that earth is the only possible agency that, in many such districts, can be brought to bear upon the mitigation or removal of existing mischiefs ;

That in towns of small or moderate size, there is no obstacle whatever in the way of the immediate application of this system, which might be efficiently worked by the local authorities acting on their own account, or by a company subject to their control in certain respects ;

That the experience gained by the adoption of the system in such places may be reasonably looked upon as likely to aid materially in the solution of sanitary problems affecting towns of the first magnitude ;

That, whether applied to institutions and large aggregates of men, or in country districts, or in towns, the advantages of the Earth System are entitled to the gravest consideration ;

That the evidence which has been adduced, and which is constantly and rapidly increasing, places its sanitary soundness and efficiency beyond doubt or question ;

And that, on each and all of these considerations, the advocates of the Earth System are justified in claiming that it shall take its proper place as a recognised agency, fairly competing on common ground with the older and more familiar methods.

APPENDIX.

WE have thought it right to add to the foregoing pages the following testimonials, selected from a large mass of similar material, mainly with a view to show the variety of forms under which the Earth System has been successfully used :—

From the Quarterly Return of Marriages, Births, and Deaths, by authority of the Registrar-General, July 31, 1867.

Earth is one of the best known disinfectants ; and in the dry state it has some of those physical properties of water, which led to the invention now so common. To a scientific clergyman of the Church of England it is due that by mechanical adaptations the Earth Closet system has been constructed, which promises to be as useful in the departments of public health and national agriculture as the Rev. Edward Cartwright's invention is in the cotton manufacture. The Rev. Henry Moule, M.A., vicar of Fordington, has shown how, in the easiest and cheapest way, soil in houses and towns can be disinfected, converted into mould, and delivered back to the uses of agriculture, whilst leaving fields uncontaminated and rivers unpolluted.

Extract from Report by Dr. Mouat, Inspector-General of Gaols in India.

It is, in my humble judgment, impossible to over-estimate the benefits that will result from the labours of the Rev. Mr. Moule in this important branch of hygiene—the dry-earth system. It is without exception the greatest public benefit, conferred by a private individual in a matter so essential to public health, that I am acquainted with.

From Captain Armytage, Governor of the West Riding Prison, Wakefield.

WEST RIDING PRISON, WAKEFIELD, Feb. 4, 1867.

Six months having expired since the Visiting Justices of this prison granted authority for bringing “Moule's Earth Closets” into use, I have great pleasure in bearing testimony to the value of the earth system. We have 800 cells without water-closets, and we are about placing Earth Closets in them. We have now 100 of the latter in use. I have not had a single complaint from either warders or prisoners since we commenced using the Earth Closets. The Earth Closet cells are without the smell that commonly exists in the water-closet cells.

The supply of dry earth is given weekly, or when required, the closet containing at the back (with care) a sufficient supply for fourteen days ; however,

to be quite secure, the pans are emptied, and a fresh supply of earth given once a week without the slightest smell in the building during the time of removal.

We have taken the precaution to make the Earth Closets self-acting; this leaves nothing to be done by the prisoners that can disarrange the apparatus. We have established a small kiln for drying the earth, and can always keep up a good supply. The earth, after being used in the closets, is turned over, and pulverised once a week during the first three weeks, when it is quite fit for the farmer or gardener. No smell arises from working the soil, and in time I anticipate a profitable return for the first outlay. I shall during the coming year be enabled to observe the effect of the manure on the crops grown within the prison.

Where the closets are in use, we have been able to do without the deodorising powder used formerly, and during the late hard frosts we were obliged to place the Earth Closets in cells already supplied with water-closets, the pipes being frozen. Our plumber is much in favour of the Earth Closets; he strongly recommends that in future they should be placed in all parts of the prison in lieu of the water-closets (an opinion certainly against his own interests).

G. ARMYTAGE, Captain,
Governor.

Dorset County School, Dorchester.

February 11th, 1867.

Having been requested to give my opinion as to the working of the Patent Earth Closets which have been in use for the last fifteen months in the County School, I beg leave to state the following particulars.

We resolved to try the Earth Closets in consequence of the water-closets getting continually out of order. As a matter of course, offensive smells as often arose, and we had reason to believe that a severe sickness which befell us was mainly to be attributed to this fact. I am thankful to state that since the introduction of these Earth Closets we have been free from both offensive smells and sickness. One very great advantage in them is, that it is hardly possible for them to get out of repair; at any rate ours have cost us nothing as yet, nor are they likely to do so, whilst, on the other hand, under the old system, the cost for repairs for two years amounted to more than £4.

It is, perhaps, well to add that there is nothing offensive to the sight or the smell in the removal of the earth from the premises. On one occasion, when some quantity was being removed in open day, three medical men of this town gave testimony that they could discover nothing offensive.

R. G. WATSON, M.A.

From J. James, Esq., Halton, Tring. To the "Times."

Sept. 17, 1866.

The process of deodorisation by earth, referred to in Mr. Hawksley's letter in the *Times* of Friday last, may be seen in full operation on Baron Rothschild's estate here.

Any one taking an interest in the improvement of the condition of the poor, and the state of our rivers, would do well to satisfy himself of the truth of Mr. Hawksley's views by a personal inspection of the whole process.

In the earth sheds here he may see excrementitious matter on its first removal from the closets, and in barrels, dried and ready for the corn and turnip drills. In all its stages it is perfectly inodorous, even when subjected to the fiercest summer heat.

The deodorisation may be effected either by the rough and ready application of a shovel-full of garden earth every day, or by the more refined and very effective apparatus patented by the Rev. H. Monle. It is with this little machine that the Halton closets are fitted; they are cheap, self-acting, and cannot get out of repair.

To the benefit conferred by them on the poor, the cottagers themselves will speak. There are yet enough of the old cesspools remaining to enable a visitor to appreciate at a glance the perfection of the Earth Closet system.

I can see no reason why this method should not be adopted in towns. It is inexpensive and most efficacious, requiring no better engineer than a journeyman carpenter. The earth may be taken in at long intervals and stored like coals, while the cesspools might remain unemptied for three, six, or twelve months, according to their size or the convenience of the tenant, without causing the smallest annoyance.

With rare exceptions, existing water-closets and cesspools are available for the earth method, and are readily adapted at a very trifling expense.

J. JAMES.

From J. Smedley, Esq.

MATLOCK BANK HYDROPATHIC ESTABLISHMENT, RIBER CASTLE, MATLOCK;
AND LEA MILLS, NEAR DERBY. *May 31, 1866.*

GENTLEMEN,—I find your Patent Earth Closets a perfect success. It may be used in any room without the slightest effluvia being perceived.

J. SMEDLEY.

From Sir J. H. Lethbridge, Hillsborough Terrace, Ilfracombe.

I consider the Earth Closet amongst the greatest boons offered to poor suffering humanity.

From Wentworth Esck, Esq.

SHERRINGTON BRAY, *November 8th, 1868.*

GENTLEMEN,—In reply to your inquiry respecting the Earth Closets, I have to say that I consider them preferable to water-closets, as being more completely free from disagreeable smells. I do not find any practical difficulty in their use.

WENTWORTH ESCK.

MESSRS. EDMUNDSON AND CO., 9, Upper Abbey Street, Dublin.

From the Rev. J. W. Neat.

WYKE HOUSE, NEAR WEYMOUTH, *February 12th, 1867.*

Mr. Moule having requested me to send you my opinion of the Patent Earth Closet invented by him, I can safely say that it is a great improvement upon the old plan of out-of-door vaults, and in-door water-closets, there being no smell, no derangement of water-pipes by frost, &c., and, moreover, the Earth Closet furnishes the best manure of the garden.

I lately used one of the Portable Earth Commodes for a sick room. It was there for a week, in repeated daily use, and not emptied till the end of the week; there was no smell during all the time. I so entirely approve of the plan that I am now having the out-of-door places altered into Earth Closets for my pupils. You can make what use you like of this note.

J. W. NEAT.

From Oswald Foster, Esq., Hitchin.

HITCHIN, *March 19, 1866.*

GENTLEMEN,—Your Earth Closets have been in use for two years in the sick wards at the Hitchin Union-house. As medical officer of that establishment I can speak with the greatest confidence of the vast convenience and comfort they have been to the inmates, indeed, to all connected with the institution, as, since their introduction, the annoyance and evil of disgusting effluvia attendant upon the use of the old-fashioned commodes have been avoided. The prejudice in the minds of many, not only amongst the poor but the more educated, at the introduction of anything new is patent to most; but I feel sure that any attempt to return to the old commode would create great dissatisfaction amongst the occupants of our sick wards.

OSWALD FOSTER, Surgeon.

From John Wilson, Esq., Edington Mains.

Hitherto, we regret to say, that the numerous and costly attempts that have been made to separate the fertilizing matter from the water in which it is contained have proved utter failures. The most feasible plan for the utilisation of nightsoil is that brought forward by the Rev. HENRY MOULE, of Fordington Vicarage, Dorset.

From the Rev. H. B. Miles.

BURLESTON RECTORY, DORCHESTER, *January 29, 1866.*

GENTLEMEN,—Some months ago, having constant trouble with my water-closet, which was very much out of repair, I determined to make a trial of the dry-earth system in its place. I have now in constant use one of your *self-acting* Earth Closets, and my purpose in writing is to express my perfect satisfaction with it in every respect. It occupies the place of the old closet upstairs, the soil falling into an enclosed space beneath, about five feet square, reaching to the ground-floor, and with a small door opening into the yard, from

whence, about once a month, it is removed without the least offence. The trouble of carrying the dry earth upstairs I consider to be about equal to the pumping water into the cistern under the old plan. I have used the same earth four or five times without the least inconvenience, and have now a quantity of valuable manure for my garden. I do not think we can estimate the immense advantage a general application of this system would prove, not only in our towns and cities, but in the country at large.

HENRY B. MILES.

From Bognor. To the Editor of the "Standard."

SIR,—I am glad you think the discussion of the Earth Closet system of sufficient public importance to occupy a portion of your columns. As I have adopted that system on a somewhat large scale for a private establishment, perhaps you will permit me to say I am quite satisfied with the result. And here I will remark that only those who have been connected with schools are aware how foul and overpowering is the stench which pervades the ordinary closets which children use at schools. I am a schoolmaster, and twelve months ago I was hardly able to enter the closets which my pupils used. An unsparing use of disinfectants only mitigated the evil. Fortunately I heard of the Earth Closets; I at once erected four, all communicating with a concrete pit, and this pit is emptied by a boy once a week. My first outlay was inconsiderable, and what was a dangerous nuisance is now a source of profit. I procure dry earth without difficulty; in fact, the ashes from the fire-grates are almost enough to supply my want; and although they are not so good as earth, because they cause a little dust in the closets, I find them very good as a disinfectant. I have no disagreeable smell in the closets, which are used by 26 pupils and several adults. Managers of schools who are troubled with low fevers, &c., and who wish to change the expense attending the ordinary closets into a source of profit, will, I think, if they adopt Mr. Monle's plan, agree with me that schoolmasters owe to him a debt of gratitude.—I remain, &c.,

ALFRED CONDER, M.A.

Middleton Lodge, Bognor, Oct. 31.

From E. Campbell Baumgardt, Esq.

GROVE BRIDGE, HELLINGLY, SUSSEX, June 25, 1868.

SIR,—I forward herewith Post-Office Order for the Commode you sent me, and I wish to say I have fully tested Mr. Monle's system, and can safely pronounce it cheap, convenient, and efficient, preferable to the water-closet, which is seldom entirely free from a noxious odour, whereas from the Earth Closet there is *no smell*.

No doubt there are many persons using Monle's Closets whose opinion you would value more than mine, but I am desirous to bear testimony to the benefit I have derived from my purchase, and can but think that, with regard to all its advantages, the system requires only to be more generally known to be more generally used.

E. CAMPBELL BAUMGARDT.

From Henry L. Roper, Esq., late Major 8th Regiment.

July 27th, 1868.

GENTLEMEN,—In reply to your inquiry relative to my opinion of the Earth Closet lately forwarded to me, I have much pleasure in stating that it has afforded the utmost satisfaction. The directions for its use are most simple, and if attended to I consider it infinitely preferable to a Water Closet.

MESSRS. EDMUNDSON & Co., 9, Upper Abbey Street, Dublin.

From Sir Capel Molyneux, Bart., D.L.

CASTLE DILLON, ARMAGH, *July 27th, 1868.*

GENTLEMEN,—I have tried the Moule's Patent Earth Closets, both in the house and out of doors, during this excessive hot weather, and have found them satisfactory in every way.

To MESSRS. EDMUNDSON & Co., 9, Upper Abbey Street, Dublin.

From the Rev. James S. Fletcher.

MONKLAND RECTORY, BONMAHON, CO. WATERFORD, *Oct. 20th, 1868.*

GENTLEMEN,—Referring to your note of the 20th ult., soliciting a testimonial in favour of Moule's Earth Closets, I have pleasure in stating that it appears to me to be equal to all that the inventor has promised. It is especially desirable in glebe houses where the incumbents are subject to dilapidations, which the adoption of the Earth Closet will tend materially to diminish.

JAMES S. FLETCHER, Rector.

MESSRS. EDMUNDSON & Co., 9, Upper Abbey Street, Dublin.

From the Enniskillen Workhouse.

December 28th, 1868.

GENTLEMEN,—In reply to your letters respecting the use of Moule's Patent Earth Closets, which have now been used here for some time past, I beg to say that at first the parties acting as nurses in the Infirmary seemed not inclined to make use of it; but after a fair trial, the freedom from any foul smell and the comfort it affords the patient in the use of it, authorised them in saying that it fully answers the purpose intended, and gives general satisfaction.

ALEXANDER PRICE, Master.

MESSRS. EDMUNDSON & Co., 9, Upper Abbey Street, Dublin.

From Broadmoor Convict Lunatic Asylum.

March 28, 1868.

SIR,—During the short time the Earth Closets have been in operation at this establishment, I have no doubt of their answering all that can be required of them; in fact, I believe them to be an excellent apparatus for an establishment of this class.

GEORGE JARVIS, Clerk of Works.

*From the Lewisham Union.**September 18, 1868.*

SIR,—In reply to your letter of the 11th instant, I have much pleasure in stating, so far as we have adopted them, that the Earth Closets are a perfect success, especially in sick wards, and where closets are badly situated, with a limited supply of water. They are far preferable, as the earth is such a perfect deodoriser that no smell can arise.

WILLIAM WANT, Master.

*From the Witney Union.**September 15, 1868.*

I have much pleasure in speaking to the excellence of your Cottage Com-modes in sick rooms. They have been in use in the Witney Union more than two years. I can strongly recommend the dry-earth system, as being in my opinion the best plan yet tried.

ALEX. THOMPSON, Master.

*From the Staines Union.**September 14, 1868.*

In reply to yours of this morning, I beg to say that after several months' trial of your Earth Closets I can with confidence recommend them for general use in the like establishments. They are a great improvement upon the night-stool, and are a great boon to the inmates of the rooms where they are used. They are very little trouble, and the nurses like them exceedingly. You can make whatever use of this letter you like.

JOHN FARRELL SAUNDERS, Master.

*From the Bradfield Union Workhouse, near Reading, Berks.**September 22, 1868.*

I find the Earth Closets answer well here. They have been in use about nine months.

J. HOARE, Governor.

From the Manx Lunatic Asylum, Isle of Man.

I have had fixed, under my superintendence, 26 of your Earth Closets, and I must say they suited well, and gave general satisfaction.

CHARLES J. SINCLAIR, Clerk of Works.

*From J. R. Campbell, Esq., 17, Warwick Street, Regent Street.**October 20, 1868.*

I took one of Moule's Earth Closets to Wales, and found it most admirable; and, if testimonials are of any use, I can willingly testify to this very useful and excellent invention. In the country no one ought to be without one.

J. R. CAMPBELL.

From Rev. C. W. Dod, Edge Hill, Malpas, Cheshire.

April 14, 1869.

The soil in this neighbourhood is unsuited to cesspools, being in most parts stiff and retentive. The accumulations from privies were a serious nuisance to me when first I came here. Last year I set up four Earth Closets, and have found them so successful that I am now doing away with water-closets altogether, and erecting two Earth Closets inside the house. The used soil, after lying for a few weeks under a shed, is as odourless and clean as guano, and when used two or three times, is probably half as strong; but I am going to make experiments on this, and will send you the result.

From the Rev. J. H. Bernau, Incumbent of Belvedere, Kent.

September 14, 1868.

When, twelve years ago, I took possession of my parsonage I found my family and myself were frequently suffering from nausea and sick headaches. On investigation I found that the cause of all this was the close and unpleasant proximity of a water-closet, with its accompanying cesspool, and the deleterious gases emanating therefrom. Having had the cesspool emptied, and made free use of disinfectants, I hoped the evil would be cured. The remedy, however, was but of short duration. The old complaints again appeared, and I began to apprehend that typhoid fever would be the sure result, unless some more efficient remedy were found. Hearing of Mr. Moule's invention, I adopted the same, I confess with some misgivings and prejudice as to its probable efficacy, but found it a complete success, for ever since we have been free from all unpleasant smell and annoyance. For the information of those who wish to utilise the soil as manure, I would state that when judiciously applied it will be found equal to the best of stable manure, and even to guano itself.



APPENDIX.

SINCE the foregoing pages were written, the Volunteer Camp at Wimbledon has again been formed, and again the Earth System has stood the test successfully. There were altogether 170 Closets and Latrines, and these were used, on average, by not less than 5000 or 6000 persons daily. Earth Closets were also erected at the lavatory and ladies' cloak-room, and were used by a large number. Of course, after the controversy which took place as to the diarrhœa of last year, and the doubts thrown upon the soundness of the System, we were naturally somewhat anxious, and we made it our particular request to Surgeon Wyatt that no disinfectants should be used, but that the earth should be tried and stand upon its own alleged merits. He kindly consented; and nothing was used, either in or about the Closets. We have great pleasure in printing the following letters addressed to the "LANCET" of the 24th inst.; one from Surgeon-Major Wyatt, and the other from Captain Drake, Engineer Officer in Command of the Camp:—

"THE WIMBLEDON CAMP.

"To the Editor of THE LANCET.

"SIR,—

"In forwarding for insertion in your journal the accompanying detailed report of the cases requiring medical assistance during the period of the late meeting of the

National Rifle Association, I have also appended some independent observations upon the practical working of the dry-earth closet system from the officer commanding the Royal Engineers, who, from very considerable experience, and most thorough knowledge of this particular subject, is conversant with all its scientific bearings; and I have the more satisfaction in asking you to insert Captain Drake's opinions and recommendations, because they are completely in unison with the views I took the liberty of bringing to the notice of the profession in your journal of the 3rd inst.; and I think I am justified in the statement then made, that I did not consider the excessive amount of severe diarrhœa which prevailed last year, when the earth closets were first employed, was in any way to be associated with the system, but was probably due to the great solar heat and the unwholesome beverages indiscriminately consumed. During this meeting a better surveillance of the closets has been insisted on, and they have been used to an enormous extent by the vast concourse of people assembled; but I have heard of no complaint of any want of deodorisation; and certainly the 39 cases of diarrhœa which have been recorded were of a very trivial nature, and, strange to say, there were precisely the same number of cases treated for constipation. The flying column also, from the Aldershot Division, which numbered upwards of 3000 soldiers, and remained in this camp for three days and nights, besides undergoing the fatigue of a very exhausting field day, only recorded two cases of slight diarrhœa; but ordinary camp trenches were dug for their use, those of the earth closets being quite full, and therefore closed up by my order. I may also mention that once during the meeting the pits were emptied of their contents with no objectionable result, the night being, of course, selected for the operation. I can safely venture to affirm that this camp is, of all places, perhaps the most suitable

for thoroughly testing the value of this important sanitary invention, which has well borne the ordeal.

"There was but one solitary casualty in connexion with the field day operations of the 17th. A young medical officer of a Volunteer Artillery regiment received a severe contusion of the superior maxilla, dislodging several teeth; but he was able to leave the camp the same evening.

"I am, Sir, your obedient servant,

"JOHN WYATT,

"Surgeon to the National Rifle Association."

DETAILED MEDICAL REPORT,

For the period from the 5th to the 17th of July, 1869.

	Average number sleeping in camp.	Diarrhoea.	Dyspepsia.	Constipation.	Bronchitis.	Tonsillitis.	Rheumatism.	Febricula.	Debility.	Inflammation of eye.	Epilepsy.	Skin disease.	Boils.	Contusion.	Burns.	Dog bite.	Gunshot accidents.	Treated in camp.	Treated in hospital.	TOTAL.
Army . . .	670	...	1	5	...	1	...	...	...	...	...	...	1	8	...	...	1	17	...	17
Volunteers . .	1071	21	9	9	...	6	3	1	2	4	2	1	1	10	...	1	...	61	9	70
Police . . .	265	5	2	5	...	...	...	...	...	...	...	...	...	6	...	...	...	17	1	18
Camp followers	419	13	6	20	2	3	1	1	5	4	...	1	3	10	2	...	...	71	...	71
Total . . .	2425	39	18	39	2	10	4	2	7	8	2	2	5	34	2	1	1	166	10	176

Camp Hospital, Wimbledon, July 18th, 1869.

“THE DRY-EARTH CLOSET SYSTEM.

“*To the Editor of THE LANCET.*

“I CONSIDER this the best system known for military latrines, when a supply of suitable earth is obtainable. In introducing this system into barracks or permanent camps, I should attend to the following points:—

“*Earth.*—This should be a clayey loam, friable, and thoroughly dried. No soil must be used which contains vegetable matter. In 1868, at Wimbledon, a sour smell was perceived, which was found to proceed from the peat earth, the fibrous portions of which had fermented with the great heat.

“*Apparatus.*—That used by the Moule Company answers very well, especially now that the engineer has introduced the simple means by which the earth is properly distributed in its fall.

“*Vaults.*—These should be lined with brick, in cement, asphalte, or other water-tight lining, to exclude leakage from the surrounding soil, as the system ceases to be effectual when it ceases to be a dry-earth system.

“*Place.*—I should recommend building latrines back to back, with sufficient space between for the earth to be supplied and removed as necessary. In building a single row of latrines, as in the case of a row of cottages, the earth should be supplied, and the manure removed, from the outside, the inhabitants having no means of access either to the earth houses or the vaults.

“*Urinals.*—These should be entirely separated from the latrines. The supply of earth should be given by hand, no self-acting apparatus being found to answer. Pioneers should go round twice a day at least, and supply the amount of

earth required, care being taken that the layer supplied at any one time should not exceed three inches in thickness. The part of the urinal liable to be watered against should be of slate rubbed smooth, *but not enamelled*. This is found to resist the action of urine better than any other material.

“*Washing water*.—The refuse water from kitchen sinks, &c., should be drained into cesspools accessible to a cart in the same way as the latrines. It can then be pumped into a cart and removed. It would be very valuable for garden purposes.

“I believe that when the value of the manure becomes better known, there will be no difficulty in finding contractors to supply the dried earth and remove the soil and sink water, paying fairly for the privilege.

“MERVIN DRAKE,

“Commanding Royal Engineers at Wimbledon.

“CAMP, WIMBLEDON,
July 18.”

These letters speak very clearly as to the practical utility of the Earth System, and surely dispel all doubt as to its sanitary effect. But anxious to place this beyond doubt, we have employed a skilful and experienced chemist to investigate the subject, and we subjoin his report, received within the last few days :—

“TO MESSRS. GIRDLESTONE,

“*Engineers to MOULE’S PATENT EARTH CLOSET COMPANY.*

“I have been engaged for some time past upon certain minute investigations connected with the important question of deodorisation of fæcal matter by means of Dry Earth.

"I have likewise carefully read through the late controversy (as reported in the 'LANCET') between Dr. Geo. Rolleston, of Oxford, and the Rev. Henry Moule, but was surprised to find such a scarcity of *practical* evidence on the part of one who seems to object so strongly to the Earth Closet System.

"Dr. Rolleston published an account of his experiments with dry earth in contact with fæcal matter; and although he found that the mean of those tests afforded results *favourable* to the '*System*,' still he condemns the latter simply upon theoretical grounds.

"Now, if I take it aright, the real and simple questions at issue are as follows:—

"1. Does fæcal matter decompose in contact with dry earth?

"2. If so, what is the nature of the various products of decomposition?

"3. Does hydrated silicate of alumina and mould thoroughly absorb all or any of these products?

"As regards the first question, little need be said in answer. Every scientific man must admit that fæces, *at the time of deposition*, are in a state of transition or decay; and as regards my own experience of the manure from the Earth Closets, as obtained by repeated analyses and careful examinations, I have always found a most intimate union of the organic and mineral constituents, together with the entire absence of *smell*.

"*Secondly*, as regards the *nature* of the products of decomposition. Of these we have found *ammonia* and volatile compounds of ammonia, such as the carbonate and hydro-sulphide, together with carbonic *acid* and *oxide*, and

certain odorous organic vapours, of the composition of which we know nothing.

“Now, does earth absorb any or all of these? I have tried experiments similar in nature to those of Dr. Rolleston, viz., by passing a current of *purified* air, by means of an ‘*aspirator*,’ slowly and for a protracted period over mixtures of fæcal matter and dry earth, and afterwards testing the same for carbonic acid, and by Nessler’s test for ammonia, as well as by the usual test for *alkaline sulphides*, and the conclusion at which I have arrived is this: That dry earth is for the deodorising of fæcal matter the best substance that can be used for the purpose.

“My first experiment was made with a coarse sample of the Wimbledon clay (previously dried); but, on account of the size of the lumps, *perfect* deodorisation *was not* effected. The experiment was repeated with the same sample fairly pulverised, affording most satisfactory evidence of its power to absorb noxious effluvia.

“Again, I found that the earth had a *better* deodorising action when only *partially dried*; a small quantity of moisture, viz., about ten to fifteen per cent., was beneficial, acting probably as a carrier to the soluble gaseous products of decomposition. Again, I found that samples of earth containing clay were more effectual for deodorising purposes than purely vegetable mould, although the two may be most judiciously mixed.

“Now, as regards the ‘*malaria*’ and ‘*miasma*’ producing vapours, spoken of by Dr. Rolleston in the number of the ‘*LANCET*’ for March 6, 1869, I would ask, where is there any *practical proof* of the existence of such exhalations arising from the Earth Commode? And again, if dry earth thoroughly and effectually absorbs so *diffusive* a gas as ammonia, or else the still more penetrating *odours* that arise from decomposing fæces, is it not reasonable to

infer that other organic vapours could be as effectually arrested ?

“Look at Nature herself! It has been proved by the most able and scientific men that earth in contact with *manuring agents* not only *absorbs* but actually decomposes their constituents, causing most complex union and reunion. The domestic cat teaches us a lesson, and so does the wild and untaught Hindoo.

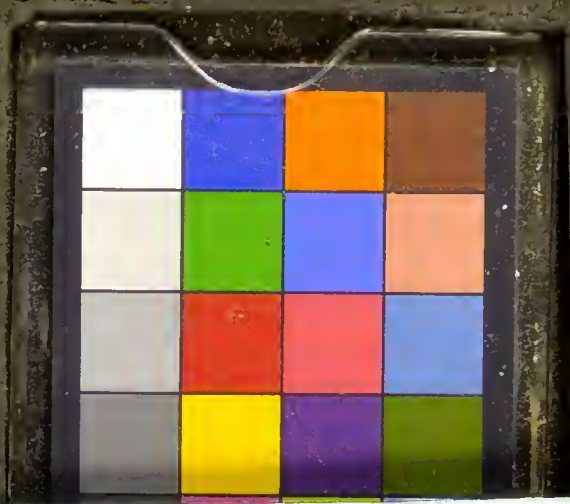
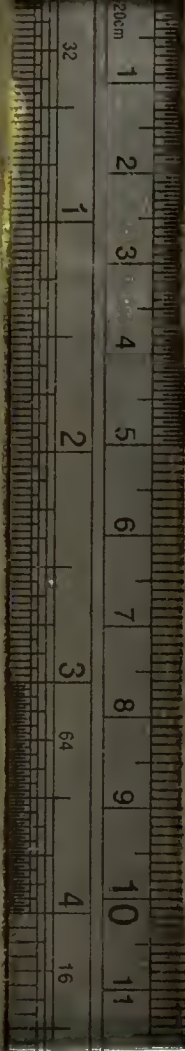
“The Earth Closet System, when *used*, and not *abused*, is, in my opinion, deserving of all support ; and I trust at some future time, if health and time are vouchsafed me, to enter more fully and minutely into experimental proof of the efficacy of *Nature's own deodoriser—Earth*.

“GEORGE JONES, F.C.S.”

“106, LEADENHALL STREET,

“15th July, 1869.”





DICTATED

SOME TIGHT
GUTTERS

